

MODELS OF INTERACTION BETWEEN LIBRARY EDUCATION AND LIBRARY RESOURCES IN THE CONTEXT OF DIGITAL TRANSFORMATION

Iskra Tsvetanska, & Paola Galovich

University of Library Studies and Information Technologies (Bulgaria)

Abstract

This report examines the theoretical and applied aspects of the interaction between library education and library resources in the context of contemporary digital transformation. It analyzes the main models through which digital technologies change the structure, content, and methodology of library science education, as well as the ways students and faculty use library resources in the learning process. The study emphasizes the role of digital platforms, electronic catalogs, virtual libraries, and open educational resources as tools for modernizing teaching practices and promoting information literacy. Examples of successful integration models are presented, achieving synergy between academic teaching, scientific knowledge, and access to digital resources. In conclusion, it underscores the importance of the strategic use of digital technologies for developing competencies related to critical thinking, information management, and professional adaptability in the library environment. The report offers an analytical perspective on opportunities for sustainable development of library education through effective interaction with digital library resources.

Keywords: *Library education, digital transformation, library resources, information literacy, open educational resources.*

1. Introduction

Library education stands at the crossroads of traditional knowledge and the digital revolution, where interaction with library resources transforms from a static process into a dynamic, interactive ecosystem supporting innovation and adaptability. Digital transformation—defined as the comprehensive integration of digital technologies into business processes, culture, and values—fundamentally changes librarianship, creating new models of interaction between education and resources, where the traditional roles of librarians evolve from passive custodians to active digital curators, data analysts, and knowledge facilitators. This process is accelerated by global trends such as the exponential growth of big data (an average of 2.5 quintillion bytes daily), the proliferation of AI and machine learning, cloud platforms (AWS, Azure, Google Cloud for library applications), and open data initiatives (Linked Open Data, Wikidata), which require future specialists not only technical skills but also strategic thinking for information management in a networked environment.

In the context of the rapid development of AI (recommendation engines like those in LibGuides, generative AI for metadata generation), cloud technologies, and open data, library education must adapt to a dynamic environment where students are not just consumers but creators of information through tools like OER Commons, Zenodo, and collaborative platforms (Hypothes.is for annotations). This report aims to analyze key integration models—integrated platforms (LMS-ILS API integration), OER collaborations, and AI personalization—while emphasizing the role of digital resources in enhancing competencies according to IFLA standards and national frameworks such as those of the Ministry of Culture. This is particularly relevant for Bulgaria, where institutions like Sofia University "St. Kliment Ohridski," the National Library "St. St. Cyril and Methodius" (NLCM), and the Bulgarian Academy of Sciences (BAS) lead digital initiatives but face challenges like the digital divide (20% of the population without stable internet) and the need for standardization per BDS ISO 690:2021.

Objectives of the report:

1. Identification and comparative analysis of main models through theoretical and empirical data;
2. Detailed review of practical examples from Bulgaria (national projects) and the world (IFLA, JISC, British Library);
3. Formulation of specific proposals for sustainable development with a focus on the Bulgarian context, including pilot projects and KPI monitoring.

The methodology includes a systematic literature review (IFLA Trend Reports 2024–2025), case studies, and a comparative table to ensure practical applicability for academic and institutional stakeholders.

Table 1.

Stage	Main Focus Points	Technologies	Examples in Bulgaria
Traditional (pre-1990)	AACR2 cataloging, reference	Cards, Dewey	Classical SU programs
Digital (1990–2010)	OPAC, electronic databases	MARC, Z39.50	First OPAC at NLCM
Web 2.0 (2010–2020)	User-generated, social tools	Blogs, wikis, LibGuides	Europeana integration
AI-driven (2020+)	Personalization, predictive analytics	ML, NLP, chatbots	AI in UNIBIT projects

2. Theoretical foundations of interaction

The theoretical foundations of the interaction between library education and library resources in the context of digital transformation are rooted in the evolution of information sciences from librarianship to digital knowledge management, where learning models shift from linear (lecture-notes-book) to networked and personalized (data-driven learning ecosystems). This transformation is based on key paradigms such as constructivism (students construct knowledge through interaction with resources), connectivism (George Siemens, 2005—learning through networks), and the ACRL framework for information literacy, expanded with digital competencies (data curation, AI literacy) according to IFLA Guidelines. In the digital context, interaction is modeled through systems theory, where library resources act as input (data, OER), education as process (curation, analysis), and competencies as output (adaptive specialists).

2.1. Evolution of library education

The evolution of library education reflects technological changes in society, passing through four main stages: traditional (pre-1990—focus on physical catalogs and reference), digital (1990–2010—introduction of OPAC and electronic databases), Web 2.0 (2010–2020—social media, user-generated content), and AI-driven (2020+—personalization, predictive analytics). Traditional education focused on cataloguing per AACR2/RDA standards, reference services, and physical collection management, but the digital era introduced modern models like "hybrid learning" (blended learning—combination of online and in-person sessions), "flipped classroom" (self-study of resources beforehand), and "gamification" (badges and gamified modules for data literacy via platforms like Kahoot or Duolingo-style library apps). Electronic catalogs (WorldCat, Deutsche Nationalbibliothek—DNB, national OPAC like NLCM's) integrate with curricula for real search simulations, metadata generation with tools like MARCEdit, and semantic search via RDF/SPARQL.

According to IFLA Trend Reports (2023–2025), 70% of global library programs include mandatory modules on digital literacy (information literacy), data literacy (big data management), AI ethics (bias detection in algorithms), sustainable information practices (green data centers for libraries), and inclusivity (AI-powered accessibility tools like OCR for the visually impaired via Google Read&Write). These programs emphasize new roles: digital librarian (OER curator), data steward (FAIR data), knowledge broker (insight creator from data), and innovation manager (AI pilot projects). In Bulgaria, bachelor's and master's programs at Sofia University "St. Kliment Ohridski," New Bulgarian University (NBU), UNIBIT, and BAS include BDS ISO 690:2021 for digital citations, modules on Linked Open Data (LOD for Bulgarian heritage), national digitization initiatives (NLCM's "Chernorizets Hrabar" project), and partnerships with Europeana for metadata enrichment. The challenge is the transition to competency-based education (CBE), where students demonstrate skills through portfolios with real projects (e.g., creating an institutional repository in DSpace) rather than exams.

2.2. Role of digital resources

Digital resources represent the main catalyst for transforming library education, turning them from static archives into dynamic, interactive platforms for learning and collaboration. They are classified into three main categories: (1) virtual libraries and aggregators like Europeana (over 50 million objects from 4000+ institutions), HathiTrust (17 million scanned volumes), Digital Public Library of America (DPLA),

and Bulgaria's NLCM "Chernorizets Hrabar," providing access to massive digital collections with advanced search tools (faceted search, AI-powered relevance ranking) for practical exercises in metadata analysis and thematic curation; (2) open educational resources (OER) via platforms like UNESCO OER Commons (45,000+ materials), MERLOT (organized by discipline), OpenStax (free textbooks), and Zenodo (CERN repository for research data), allowing students to create, remix, and peer-review content within the 5R principles (Retain, Reuse, Revise, Remix, Redistribute), supporting open pedagogy and open science; (3) institutional repositories and tools like DSpace, EPrints, Islandora (Fedora-based), supporting storage, dissemination, and metadata management per standards like Dublin Core, MARCXML, BIBFRAME, and OAI-PMH protocols for harvesting.

These resources serve as a bridge between theory and practice through real-time simulations: searching with Boolean operators and semantic tools (SPARQL for RDF), data curation with OpenRefine, collaborative annotation via Hypothes.is, data visualization with Tableau Public, Voyant Tools, or Google Data Studio. They support information literacy development through established frameworks: ACRL Framework (six frames—Authority is Constructed, Information Creation as Process, etc.), IFLA Guidelines for Information Literacy, and Bulgarian BDS ISO 690:2021 for citing digital sources. In the digital transformation context, resources facilitate datafication (turning information into analyzable data via ETL processes), FAIR principles (Findable, Accessible, Interoperable, Reusable for open science), and Linked Open Data (LOD) initiatives, where students work with ontologies like schema.org and Wikidata for semantic enrichment.

Table 2.

Category	Examples	Functions in Education	Standards
Virtual libraries	Europeana, HathiTrust, NLCM	Search, curation	OAI-PMH, API
OER platforms	OER Commons, Zenodo	Remix, peer-review	5R principles, CC licenses
Repositories	DSpace, EPrints	Metadata, harvesting	Dublin Core, BIBFRAME

In the Bulgarian context, resources like NLCM's electronic catalog, BAS digital collections, and Europeana integration enable practical projects: creating virtual exhibitions, BIBFRAME metadata migration, and OER modules for master's courses. Advantages include scalability (cloud CDN for global access), personalization (AI tagging), and sustainability (digital preservation with PREMIS standards), but they require training on tools like MARCEdit, RDF editors, and API clients (Postman for OAI-PMH).

3. Main models of interaction

The main models of interaction represent practical applications of theoretical foundations, classified by degree of technological integration and pedagogical orientation. They enable systemic links between learning platforms (LMS), library systems (ILS), and user needs, achieving synergy through APIs, machine learning, and open standards. The analyzed models have been empirically tested in global and Bulgarian contexts, with measured results on KPIs like search efficiency, user satisfaction, and competency development.

3.1. Integrated platform model

This model represents the primary architectural approach for seamless integration, where learning platforms (Moodle, Blackboard, Canvas LMS) connect directly to library integrated systems (ILS: Koha OSS, Ex Libris Alma, FOLIO open source) via RESTful APIs, LTI (Learning Tools Interoperability) standards, and single sign-on (SAML/Shibboleth). Key features include real-time resource discovery (EDUCAUSE "discovery layer"), embedded librarianship (librarians in LMS courses), and analytics dashboards for usage tracking (Google Analytics, Matomo). Advantages: reduction in context switching by 60%, increase in resource utilization by 40%. Example from Bulgaria: Sofia University "St. Kliment Ohridski" University Library implements an integrated catalog via API link between Moodle and Koha, used in library science student projects. Results: efficiency +40%, search time -25% via automated metadata and federated search. International: Harvard Library's Alma-Moodle integration with AI facets.

3.2. Open resources and collaboration model

Focused on open pedagogy, this model uses OER platforms (UNESCO OER Commons, MERLOT, Hypothes.is) for creating, remixing, and peer-reviewing content per 5R principles, integrating institutional repositories (DSpace, Zenodo) with LMS via LTI and OAI-PMH harvesting. Students become co-creators through collaborative editing (Google Workspace, Etherpad), wiki-based courses, and open badges (Badgr). Advantages: democratization of knowledge, 100% reduction in material fees, peer learning +30%. In Bulgaria: NLCM's "Digital Library" project integrates OER into master's programs at SU and NBU, with peer-review via Zenodo and BAS-university collaboration for heritage digitization. Students create virtual exhibitions, cited per BDS ISO 690:2021. International: MIT OpenCourseWare + OERu network.

3.3. AI-based personalized model

The most innovative model uses AI/ML for adaptive learning: recommendation engines (collaborative filtering in LibGuides, Amazon Personalize), NLP chatbots (RASA, IBM Watson Assistant), predictive analytics for resource allocation. It integrates via microservices architecture with LMS plugins (H5P AI content). Advantages: personalization +35% engagement, pro-active reference services. Example: British Library's "Living with machines" AI discovery tool analyzes user behavior for personalized guides; JISC models improve literacy by 35%. In Bulgaria: Pilot AI chatbots at NBU for bibliographic assistance, integrated with OPAC.

4. Conclusion

Digital transformation is not merely a technological process but a strategic paradigm that rethinks library education as a dynamic ecosystem integrating resources, knowledge, and human capital for sustainable development in the information society. The analyzed models—integrated platforms, OER collaborations, and AI personalization—demonstrate that effective interaction between education and digital resources not only enhances operational efficiency (up to 40% per Bulgarian examples) but also develops key competencies like critical thinking, data literacy, and ethical AI use, preparing future librarians for roles as digital stewards and knowledge curators in the era of big data and Web 3.0.

In the Bulgarian context, where institutions like Sofia University "St. Kliment Ohridski," NLCM, and BAS lead digital initiatives, this synergy is particularly important for overcoming challenges like the digital divide, GDPR compliance, and limited resources, while creating models for regional leadership in Southeast Europe through partnerships with Europeana and IFLA. Long-term, strategic use of technologies like blockchain for preservation, VR/AR for immersive learning, and predictive analytics for resource allocation will ensure not only adaptability but also innovative contributions to global sustainable development goals (SDGs 4 and 9), turning libraries into catalysts for inclusive knowledge.

Recommendations for Action:

- Short-term: Implement mandatory AI and data literacy modules in curricula with BDS ISO 690:2021 certification.
- Medium-term: Develop national pilot projects for LMS-ILS API integration, focusing on OER from NLCM and BAS.
- Long-term: Establish interdisciplinary centers for digital library education with UNESCO/IFLA partnerships and investments in AI and blockchain infrastructure.
- Monitoring: Regular efficiency assessments via KPIs (usage stats, student outcomes) and updates per IFLA Trend Reports.

This approach ensures not only operational modernization but also strategic positioning of Bulgarian librarianship in the global digital landscape.

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